Clean Water Act Section 319(h) Nonpoint Source Pollution Control Program

Surface Water Quality Monitoring and Additional Data Collection Activities to Support the Implementation of the Plum Creek Watershed Protection Plan

TSSWCB Project 10-07
Revision 4

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Prepared by

Guadalupe-Blanco River Authority

Effective Period: January 1, 2011 – October 31, 2014
with annual revisions required

Questions concerning this quality assurance project plan should be directed to:

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A1 APPROVAL PAGE

Surface Water Quality Monitoring and Additional Data Collection Activities to Support the Implementation of the Plum Creek Watershed Protection Plan

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United States Geological Survey (USGS)

Name: Mark Null
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Signature: ______________________________ Date: ____________________

Name: Michael Nyman
Title: Data Chief, South Texas Program Office

Signature: ______________________________ Date: ____________________

The GBRA will secure written documentation from each sub-tier project participant (e.g., subcontractors, other units of government, laboratories) stating the organization's awareness of and commitment to requirements contained in this QAPP and any amendments or added appendices of this QAPP. The GBRA will maintain this documentation as part of the project's QA records, and will be available for review. (See sample letter in Attachment 1 of this document.)

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List of Acronyms

AWRL	Ambient Water Reporting Limit
BMP	Best Management Practice
BOD	Bio-chemical Oxygen Demand
CAR	Corrective Action Report
CBOD	Carbonaceous Biological Oxygen Demand
COC	Chain of Custody
COD	Chemical Oxygen Demand
CR	County Road
CRP	Clean Rivers Program
DO	Dissolved Oxygen
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
GBRA	Guadalupe-Blanco River Authority
ITRAX	Imaging Software used by GBRA
LCS	Laboratory Control Standard
LOD	Limit of Detection
LOQ	Limit of Quantitation
MPN	Most Probable Number
NWIS	National Water Information System
NCR	Nonconformance Report
NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
PCWP	Plum Creek Watershed Partnership
QA	Quality Assurance
QASM	Quality Assurance System Manual
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference
SA	Sample Amount (reference concentration)
SARA-EL	San Antonio River Authority - Environmental Laboratory
SM	Standard Methods
SOP	Standard Operating Procedure
SR	Sample Result
SWQM	Surface Water Quality Monitoring
SWQMIS	Surface Water Quality Monitoring Information System (formerly TRACS)
TCEQ	Texas Commission on Environmental Quality
TSS	Total Suspended Solids
TSSWCB	Texas State Soil and Water Conservation Board
TSWQS	Texas Surface Water Quality Standards
TWQI	Texas Water Quality Inventory
TWSC	Texas Water Science Center
USGS	U.S. Geological Survey
WPP	Watershed Protection Plan
WQMP	Water Quality Management Plan

A3 DISTRIBUTION LIST

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

EPA
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The GBRA will provide copies of this QAPP and any amendments or appendices of this QAPP to each person on this list and to each sub-tier project participant, e.g., subcontractors, other units of government, laboratories. The GBRA will document distribution of the QAPP and any amendments and appendices, maintain this documentation as part of the project's QA records, and will be available for review.

A4 PROJECT/TASK ORGANIZATION

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

EPA

Henry Brewer, EPA Project Officer
Responsible for managing the project for EPA. Reviews project progress and reviews and approves QAPP and QAPP amendments.

TSSWCB

Jana Lloyd, TSSWCB Project Manager
Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Provides the primary point of contact between the GBRA and the TSSWCB. Tracks and reviews deliverables to ensure that tasks in the workplan are completed as specified in the contract. Responsible for verifying that the QAPP is followed by the GBRA. Notifies the TSSWCB QAO of significant project nonconformances and corrective actions taken as documented in quarterly progress reports from GBRA Project Manager.

Mitch Conine, TSSWCB QAO
Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants. Assists the TSSWCB Project Manager on QA-related issues. Coordinates reviews and approvals of QAPPs and amendments or revisions. Conveys QA problems to appropriate TSSWCB management. Monitors implementation of corrective actions. Coordinates and conducts audits.

GBRA

Debbie Magin, Project Manager/Data Manager
Responsible for implementing and monitoring requirements in the contract, and the QAPP. Responsible for writing and maintaining records of the QAPP and its distribution, including appendices and amendments. Responsible for maintaining written records of sub-tier commitment to requirements specified in this QAPP. Coordinates project planning activities and work of project partners. Ensures monitoring systems audits are conducted to ensure QAPP is followed by project participants and that project is producing data of known quality. Responsible for ensuring that field data are properly reviewed and verified. Responsible for the transfer of project quality-assured water quality data to the TCEQ SWQMIS. Ensures that subcontractors are qualified to perform contracted work. Maintains quality-assured data on GBRA Internet sites. Ensures TSSWCB project manager and/or QAO are notified of deficiencies and nonconformances, and that issues are resolved. Responsible for validating that data collected are acceptable for reporting to the TCEQ SWQMIS.

Josie Longoria, QAO/Regional Laboratory Director
Responsible for coordinating the implementation of the QA program. Responsible for maintaining the QAPP and monitoring its implementation. Responsible for identifying, receiving, and maintaining project QA records. Responsible for coordinating with the TSSWCB QAO to resolve QA-related issues. Notifies the GBRA Project Manager of particular circumstances which may adversely affect the quality of data. Coordinates and monitors deficiencies, nonconformances and corrective action. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Supervises laboratory, purchasing of equipment, maintain QA manual for laboratory operations, and supervision of lab safety program. Ensures that field staff are properly trained and that training records are maintained.

Lee Gudgell, Water Quality Technician
Responsible for coordinating sampling events, including maintenance of sampling bottles, supplies, and equipment. Maintains records of field data collection and observations.

Laboratory Analyst I
Performs laboratory analysis for inorganic constituents, nutrients, etc.; assists in collection of field data and samples for stream monitoring and chemical sampling of environmental sites.

Laboratory Technician II
Performs laboratory analysis for inorganic constituents, nutrients, etc.; assists in collection of field data and samples for stream monitoring and chemical sampling of environmental sites.

Sample Custodian
Perform sample custodial duties, collect field data and samples as directed by laboratory director.

San Antonio River Authority

David Hernandez, Laboratory Director
Supervises laboratory, lab safety program, and purchasing of equipment. Reviews and verifies all laboratory data for integrity and continuity, reasonableness and conformance to project requirements, and then validates the data against the measurement performance specifications listed in Table A7.1.

Patricia Carvajal, QAO
Maintains QA manual for laboratory operations, maintains operating procedures that are in compliance with the QAPP. Responsible for the overall QC and QA of analyses performed by SARA's Environmental Services Department.

United States Geologic Survey

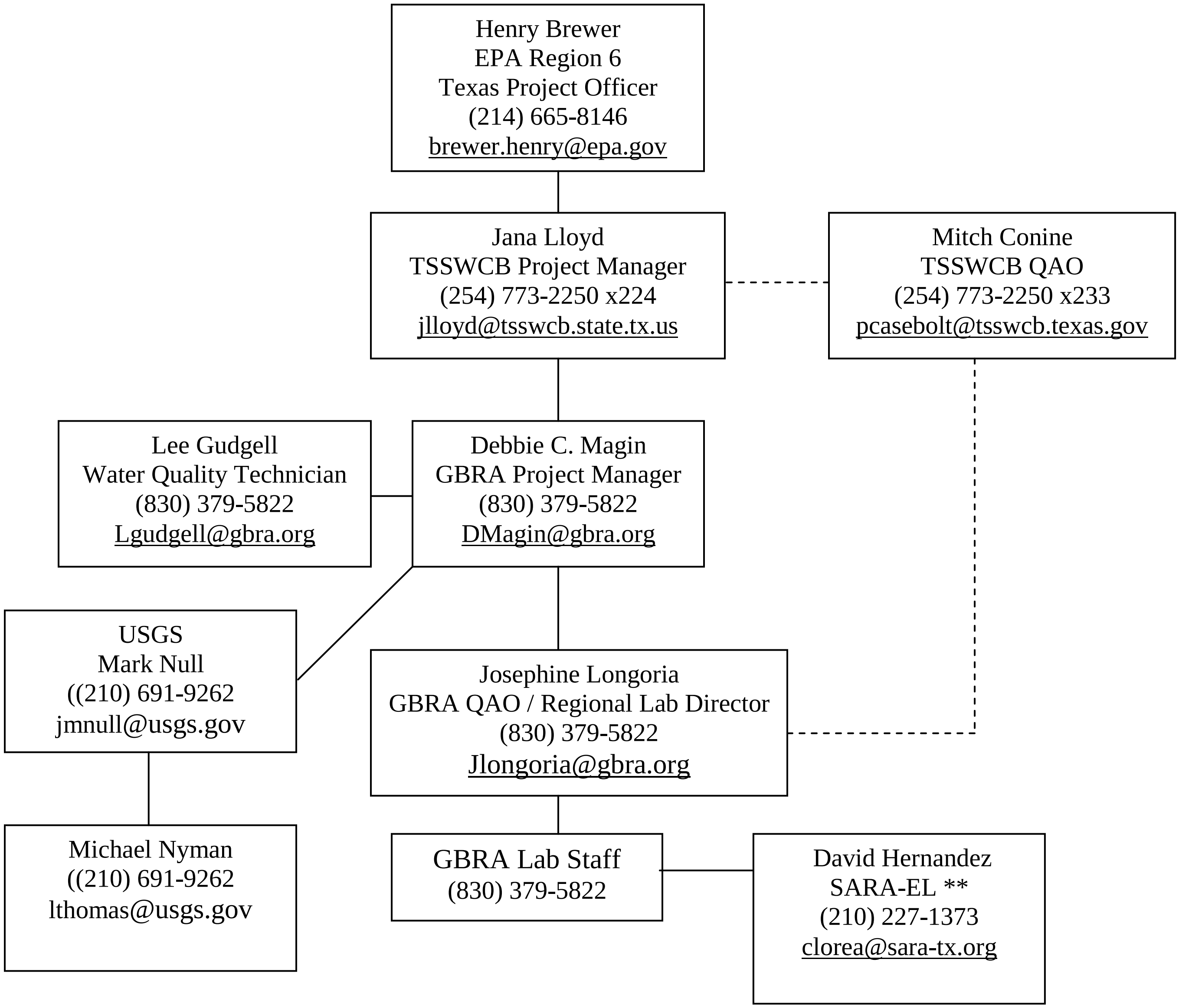
Mark Null, Chief/Project Manager
Responsible for managing and directing the South Texas Program Office, including all surface-water activities and ensuring that all aspects of the QAPP are understood and followed by Texas Water Science Center (TWSC) personnel. This is accomplished by his direct involvement or

through clearly stated delegation of his responsibility to other appropriate personnel in the TWSC. Provide final resolution of any conflicts or disputes related to the Plum Creek Gain/Loss Synoptics and for reviewing and ensuring all funding, budgeting, accounting, and expenditures associated with the Plum Creek Gain/Loss Synoptic.

Michael Nyman, Field Manager/Data Chief
Ensure that field staff follow the TWSC Surface-Water Quality-Assurance Plan (TWSC-QAPP) for collection and analysis of any data associated with the Plum Creek Gain/Loss Synoptic Survey. The TWSC-QAPP documents that standards, policies, and procedures used in activities related to the collection, processing, storage, analysis, presentation, and publication of surface-water data. Responsible for checking, reviewing, and finalizing data values associated with the survey. The Field/Data manager may, at his discretion, delegate that duty to a senior hydrologic technician with final review and approval by the Field Manager/Data Manager.

Field Staff, Hydrologic Technicians
The field staff involved in the Plum Creek Gain/Loss survey will consist of teams of two trained hydrologic technicians that will provide the manpower necessary to complete the survey. The field staff that will be assigned to the survey are mid-level and senior hydrologic technicians that have prior experience in conducting gain/loss surveys at other sites on rivers in Texas.

Figure A4.1 Project Organizational Chart* – Lines of Communication



* See Project/Task Organization in this section for a description of each position's responsibilities.
** SARA-EL to be used to meet holding times in the event of equipment failure at the GBRA Regional laboratory.

A5 PROBLEM DEFINITION/BACKGROUND

Plum Creek rises in Hays County north of Kyle and runs south through Caldwell County, passing Lockhart and Luling, and eventually joins the San Marcos River at their confluence north of Gonzales County. Plum Creek is 52 miles in length and has a drainage area of 389 mi^2. According to the *2008 TWQI and 303(d) List*, Plum Creek (Segment 1810) is impaired by elevated bacteria concentrations (category 5c) and exhibits nutrient enrichment concerns for ammonia, nitrate+nitrite nitrogen and total phosphorus.

TSSWCB and Texas AgriLife Extension Service established the Plum Creek Watershed Partnership (PCWP) in April 2006. The PCWP Steering Committee completed the *Plum Creek WPP* in February 2008. Information about the PCWP is available at http://plumcreek.tamu.edu/. Sources of pollutants identified in the Plum Creek WPP include urban storm water runoff, pet waste, failing or inadequate on-site sewage facilities (septic systems), wastewater treatment facilities, livestock, wildlife, invasive species (feral hogs), and oil and gas production.

Originally, the Plum Creek WPP was to be developed using only existing water quality data. However, discussions with stakeholders identified data gaps which would make source identification and establishment of water quality goals difficult. Accurate source identification is key to prioritizing implementation projects for funding. Through TSSWCB project 03-19, *SWQM to Support Plum Creek WPP Development*, GBRA collected water quality data to fill the identified data gaps.

Facilitated by Texas AgriLife Extension Service, implementation of the Plum Creek WPP is currently underway. TSSWCB project 08-07 *Implementing Agricultural Nonpoint Source Components of the Plum Creek WPP* provides technical assistance and financial incentives through the local soil and water conservation districts to agricultural producers in developing and implementing WQMPs. In order to reduce feral hog impacts on the stream, education and technical assistance is being provided, through project 08-07, by Texas AgriLife Extension Service to landowners in the watershed on strategies to reduce and manage feral hog populations. The cities of Kyle and Lockhart have received TCEQ CWA §319(h) funding to retrofit detention facilities to improve water quality, educate and stencil storm sewer inlets, map existing storm water facilities, implement a dog waste collection station program, and coordinate city “housekeeping” activities designed to improve water quality (street sweeping, creek cleanup days, etc). Additionally, Lockhart will evaluate their existing storm water system, identify and prioritize upgrades to the city’s storm water management system including cleaning out and installing storm drain filters, and coordinate creek cleanup days, and household hazardous and electronic waste collection days. Any stream monitoring funded in the TCEQ project will be at sites associated with retrofitted or newly installed storm water BMPs. An education and outreach campaign was initiated during the watershed planning process that focused on educating watershed residents and landowners on the impacts of specific land use activities, illegal dumping, proper operation and maintenance of OSSFs and proper disposal of pet waste.

To demonstrate improvements in water quality, the Plum Creek WPP describes a water quality monitoring program designed to evaluate the effectiveness of BMPs implemented across the watershed and their impacts on in-stream water quality. Water quality data will be used in the adaptive management of the WPP in order to evaluate progress in implementing the Plum Creek WPP and achieving water quality restoration. Sampling locations and frequencies (routine and targeted) are located so that the effectiveness of BMPs implemented in the watershed can be assessed. The city of Kyle is implementing a storm water management program that includes improvements to storm water retention ponds. The city of Lockhart is implementing a storm water management program that includes the installation of storm drain filters and an illicit discharge detection project. Both cities have included public education and outreach in their programs. Monitoring sites downstream of these two cities will collect base flow as well as flows impacted by storm water. Data collected under previous projects (TSSWCB project 03-19 and 10-54) will be used as background for comparison of data collected after the cities have implemented their respective programs. Additionally, monitoring sites have been located so that other BMPs that are recommended in the PC WPP, such as conversion of septic tanks to public wastewater system collection systems, feral hog control and water quality management plans on agricultural lands within the watershed, can be assessed for their impacts on in-stream water quality as well as their progress in achieving water quality restoration.

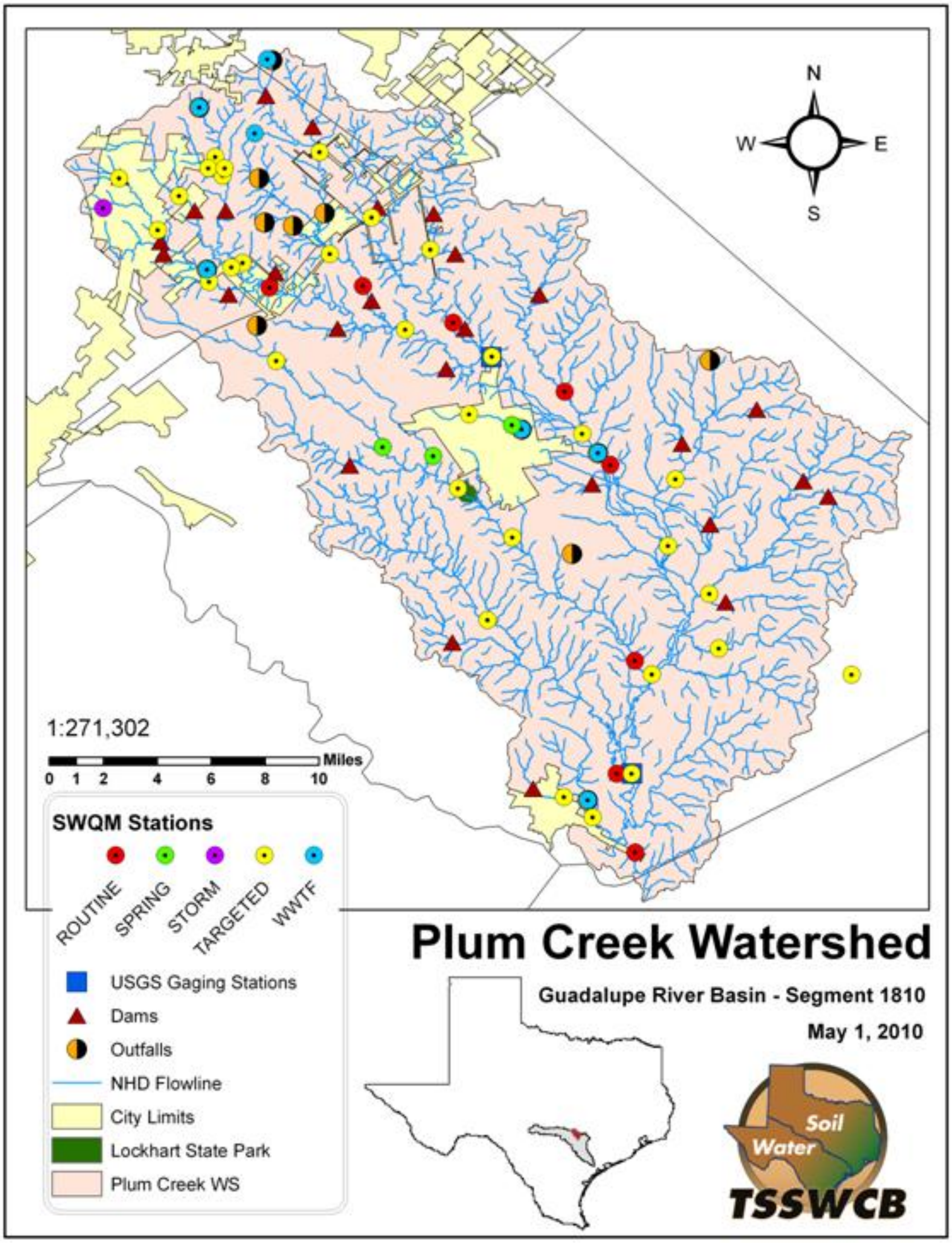
To avoid a data collection gap between the closing of TSSWCB project 03-19 and the initiation of this project, TSSWCB utilized state general revenue funds for project 10-54 *SWQM to Support the Implementation of the Plum Creek WPP* to continue main stem and some tributary snapshot SWQM.

There is a need to continue the monitoring regime originally funded through TSSWCB project 03-19 and to implement the monitoring program described in the Plum Creek WPP which has begun, short-term, through TSSWCB project 10-54.

When the load duration curves for the Watershed Protection Plan were being developed there was an observed loss of flow between mid and lower index sites. As a result, the need to perform a gain/loss survey was identified to better define the relation between streamflow and groundwater recharge in the Plum Creek watershed.

The purpose of this QAPP is to clearly delineate GBRA QA policy, management structure, and procedures, which are used to implement the QA requirements necessary to verify and validate the surface water quality data collected. Figure A5.1 is a map of the Plum Creek watershed.

Figure A5.1 Plum Creek Watershed and Sampling Locations



A6 PROJECT/TASK DESCRIPTION

Through this project, GBRA will collect SWQM data to characterize the Plum Creek watershed, including the contributing wastewater effluents. Monitoring data will be used to assess and evaluate the effectiveness of the BMPs that have been or will be implemented in the watershed as a result of the Plum Creek WPP. The sampling regime will include diurnal, spring flow, storm event and targeted monitoring under more typical base flow conditions over the next three years. This will provide a more complete and representative data set to characterize the Plum Creek watershed and document water quality improvements.

GBRA will conduct the majority of the work performed under this project including technical and financial supervision, preparation of status reports, coordination with local stakeholders, SWQM sample collection and analysis, and data management. GBRA will participate in the PCWP, Steering Committee, and Technical Advisory Group in order to communicate project goals, activities and accomplishments to affected parties. GBRA will continue to host and maintain an Internet webpage http://www.gbra.org/plumcreek/ for the dissemination of information.

Currently, routine ambient water quality data is collected monthly at 3 main stem stations by GBRA (17406, 12640 and 12647) through the CRP. Through this project, GBRA will conduct routine ambient monitoring at an additional 5 sites monthly over 34 months, collecting field, conventional, flow and bacteria parameter groups. This will complement existing routine ambient monitoring regime conducted by GBRA such that routine water quality monitoring is conducted monthly at 8 sites in the Plum Creek watershed.

GBRA will conduct targeted watershed monitoring at 35 sites twice per season, once under dry weather conditions and once under wet weather conditions, collecting field, conventional, flow and bacteria parameter groups. Sampling period extends through 11 seasons. Spatial, seasonal and meteorological variation will be captured in these snapshots of watershed water quality.

GBRA will conduct 24-hour DO monitoring at 7 sites monthly during the index period collecting field and flow parameter groups. These sites shall be the same as the sites for routine ambient monitoring, except for the site at CR202 because GBRA currently maintains a continuous water quality monitoring module that collects the flow and field parameters every fifteen minutes. Sampling period extends over 8 months during the index period of each year of the project, except for year 3, in which the diurnal sampling will end at the end of the contract period.

GBRA will conduct effluent monitoring at seven wastewater treatment facilities (WWTFs) once per month collecting field, conventional, flow, bacteria and effluent parameter groups. The sampling period will extend over 34 months. This will characterize WWTF contributions to flow regime and pollutant loadings. To supplement the data collected at the WWTFs, GBRA will compile all the weekly permit effluent monitoring data as submitted by permitees that includes BOD, TSS, volatile suspended solids, *E. coli*, ammonia nitrogen and total phosphorus from seven WWTFs.

GBRA will conduct spring flow monitoring at 3 springs once per season collecting field, conventional, flow and bacteria parameter groups. The sampling period will extend over 11 seasons. Spatial and seasonal variation in spring flow will be captured. This will characterize spring contributions to flow regime and pollutant loadings.

GBRA will conduct automated storm event monitoring up to 3 urban/residential sites during 4 storm events each year (once per quarter) for 12 months, collecting field, conventional, flow and bacteria parameter groups. Depending on meteorological conditions, seasonal variation in storm events will be captured.

Through this project, GBRA will contract with the United States Geologic Survey (USGS) to perform two gain/loss synoptic surveys during sustained base flow conditions in the Plum Creek Watershed. The USGS will conduct the surveys at five locations in the Plum Creek watershed The timing of the synoptic surveys will be dependent on hydrologic conditions. Surface-water discharge measurements will be collected at each gain/loss locations and will include, at a minimum, two independent flow measurements, for a total of 20 discharge measurements for both synoptic events. All measurements will be quality assured and the results will be entered into the USGS's National Water Information System (NWIS) database and will be published in the USGS's annual report of water-resource data.

GBRA will post monitoring data to the GBRA website in a timely manner. GBRA will summarize the results and activities of this project through inclusion in GBRA's CRP Basin Highlights Report and/or Basin Summary Report. Additionally, the results and activities of this project will be summarized in quarterly reports to the stakeholders of the PCWP Steering Committee and in revisions to the Plum Creek WPP. GBRA will develop a final Assessment Data Report summarizing water quality data collected through Tasks 3-8 of the workplan. The Report shall, at a minimum, provide an assessment of water quality with respect to effectiveness of BMPs implemented and a discussion of interim short-term progress in achieving the Plum Creek WPP water quality goals.

See Appendix A for sampling design and monitoring pertaining to this QAPP.

Table A6.1 QAPP Milestones

TASK	PROJECT MILESTONES	AGENCY	START	END
2.1	Develop DQOs and QAPP for review by USEPA.	GBRA	M1	M2
2.2	Submit revisions to QAPP as necessary.	TSSWCB, GBRA	M3	M36
3.1	GBRA will monitor at 5 routine sites monthly, collecting field, conventional, flow and bacteria parameter groups.	GBRA	M3	M36
4.1	GBRA will conduct targeted monitoring at 35 sites, twice per season, once under dry conditions and once under wet conditions, collecting field, conventional, flow and bacteria parameter groups.	GBRA	M3	M36
5.1	GBRA will conduct automated storm event monitoring at 3 urban/residential sites during four storm events annually, collecting field, conventional, flow and bacteria groups.	GBRA	M25	M36
6.1	GBRA will conduct 24-hour DO monitoring at 7 sites monthly during the index period, collecting field and flow parameter groups.	GBRA	M3	M36
7.1	GBRA will conduct wastewater effluent monitoring at 7 WWTFs once per month, collecting field, conventional, flow, effluent and bacteria parameter groups.	GBRA	M3	M36
8.1	GBRA will conduct spring flow monitoring at 3 springs once per season, collecting field, conventional, flow and bacteria parameter groups.	GBRA	M3	M36
10.1	USGS will conduct a gain/loss survey.	USGS	M3	M36

A7 QUALITY OBJECTIVES AND CRITERIA FOR DATA QUALITY

The purpose of routine water quality monitoring is to collect surface water data needed for water quality assessments in accordance with TCEQ's *Guidance for Assessing and Reporting Surface Water Quality in Texas*. These water quality data, and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be subsequently reconciled for use by the TSSWCB.

Systematic watershed monitoring, i.e., targeted monitoring, is defined by sampling that is planned for a short duration (1 to 2 years) and is designed to: screen waters that would not normally be included in the routine monitoring program, monitor at sites to check the water quality situation, and investigate areas of potential concern. Targeted monitoring in the Plum Creek watershed, done under wet and dry conditions, will be collected to capture spatial, seasonal and meteorological snapshots of water quality.

GBRA will conduct diurnal water quality monitoring monthly during the index period. The diurnal monitoring will adhere to the specifications described in the TCEQ *SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008* (RG-415). GBRA will also conduct effluent monitoring at 7 WWTFs to characterize the contributions to flow and pollutant loadings. Monitoring will be conducted on spring flow to characterize contributions to the flow and pollutant loadings. Automated stormflow sampling will be conducted at three locations in the watershed a minimum of once per season as meteorological conditions allow. Spatial, seasonal and meteorological variations will be captured. The data will be used to determine whether any of the springs contribute significantly to the flow regime or to the loading of pollutants that have led to the impairment of the stream. These water quality data will be subsequently reconciled for use and assessed by the TSSWCB.

The monitoring regime (targeted, routine, storm, 24-hour DO, effluent, and spring sampling) is designed to evaluate the effectiveness of BMPs (both rural and urban) across the watershed and measure their impacts on in-stream water quality. Water quality trends will be continually evaluated to document progress in implementing the WPP and progress in achieving restoration. This project is a part of a long-term monitoring program which will extend over the 10 year implementation schedule of the WPP.

The USGS will conduct two gain/loss synoptic surveys during sustained base flow conditions in the Plum Creek watershed. The timing of the synoptic surveys will be dependent on hydrologic conditions. Surface-water discharge measurements collected at each gain/loss location will include at a minimum, two independent flow measurements, for a total of 20 discharge measurements for both synoptic events. Subsequent additional flow measurements may be collected during each synoptic, if the measurements exceed the measurement criteria of greater than 3% deviation from the preceding measurement. All measurements will be entered into the USGS's NWIS database and stored under the USGS station number. Each of the measurement sites will be assigned a USGS discharge measurement number. Results of the synoptic measurements will be published in the USGS's annual report of water-resources data.

The measurement performance specifications to support the project objectives for a minimum data set are specified in Table A7.1 and in the text following.

Table A7.1 GBRA Measurement Performance Specifications

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	AWRL	LOQ	LOQ CHECK STD %Rec	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
Field Parameters										
pH	pH/ units	water	SM 4500-H^+ B. & TCEQ SOP, V1	00400	NA[1]	NA	NA	NA	NA	Field
DO	mg/L	water	SM 4500-O G. & TCEQ SOP, V1	00300	NA[1]	NA	NA	NA	NA	Field
Conductivity	umhos/cm	water	SM 2510 & TCEQ SOP, V1	00094	NA[1]	NA	NA	NA	NA	Field
Temperature	^{o}C	water	SM 2550 & TCEQ SOP, V1	00010	NA[1]	NA	NA	NA	NA	Field
Flow	cfs	water	TCEQ SOP, V1	00061	NA[1]	NA	NA	NA	NA	Field
% pool coverage in 500 meter reach	%	water	TCEQ SOP, V2	89870	NA[1]	NA	NA	NA	NA	Field
Depth of bottom of water body at sample site	m	water	TCEQ SOP, V2	82903	NA[1]	NA	NA	NA	NA	Field
Maximum pool width at time of study	m	water	TCEQ SOP, V2	89864	NA[1]	NA	NA	NA	NA	Field
Maximum pool depth at time of study	m	water	TCEQ SOP, V2	89865	NA[1]	NA	NA	NA	NA	Field
Pool length	m	water	TCEQ SOP, V2	89869	NA[1]	NA	NA	NA	NA	Field
Days since precipitation event	days	other	TCEQ SOP, V1	72053	NA[1]	NA	NA	NA	NA	Field
Primary contact, observed activity	# of people	other		89978	NA[1]	NA	NA	NA	NA	Field
Evidence of primary contact recreation	1-observed 0-not observed	other		89979	NA[1]	NA	NA	NA	NA	Field
Flow measurement method	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	TCEQ SOP, V1	89835	NA[1]	NA	NA	NA	NA	Field
Flow severity	1-no flow 2-low 3-normal 4-flood 5-high 6-dry	water	TCEQ SOP, V1	01351	NA[1]	NA	NA	NA	NA	Field
Flow Estimate	cfs	water	TCEQ SOP, V1	74069	NA[1]	NA	NA	NA	NA	Field
Conventional and Bacteriological Parameters										
Conductivity[3]	umhos/cm	water	SM 2510	00095	NA[1]	NA	NA	NA	NA	GBRA
Residue, Total Nonfiltrable (TSS)	mg/L	water	SM 2540D	00530	4	1[7]	NA	20	80-120	GBRA[6]
Turbidity	NTU	water	SM 2130B	82079	0.5	0.5	NA	20	NA	GBRA[6]
Sulfate	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00945	5	1	70-130	20	80-120	GBRA[6]

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	AWRL	LOQ	LOQ CHECK STD %Rec	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
Chloride	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00940	5	1	70-130	20	80-120	GBRA[6]
Chlorophyll-a, spectro-photometric method	ug/L	water	SM 10200-H[4]	32211	3	1[7]	70-130	20	NA	GBRA
Pheophytin, spectro-photometric method	ug/L	water	SM 10200-H[4]	32218	3	1	70-130	20	NA	GBRA
E. coli, IDEXX™ Colilert[8]	MPN/100 mL	water	Colilert - 18	31699	1	1	NA	0.5[2]	NA	GBRA
Ammonia-N, total	mg/L	water	EPA 350.1 Rev. 2.0 (1993)	00610	0.1	0.1	70-130	20	80-120	GBRA
Hardness, total (as $CaCO_3$)	mg/L	water	SM 2340 C	00900	5	5	NA	20	80-120	GBRA
Nitrate-N, total	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00620	0.05	0.05	70-130	20	80-120	GBRA[6]
Total phosphorus[5]	mg/L	water	EPA 365.3	00665	0.06	0.05	70-130	20	80-120	GBRA[6]
Total Kjeldahl Nitrogen	mg/L	water	EPA 351.2 Rev. 2 (1993)	00625	0.2	0.2	70-130	20	80-120	GBRA[6]
BOD, 5-day	mg/L	water	SM 5210B	00310	2	1.0	NA	<10 = 33.3 >10 = 15.4	NA	GBRA
CBOD, 5-day	mg/L	water	SM 5210B	80082	2	1.0	NA	<10 = 33.3 >10 = 15.4	NA	GBRA
COD	mg/L	water	SM 5220D	00335	10	10.0	70-130	20	80-120	GBRA
Diurnal monitoring summary statistics										
24-hour average DO	mg/L	water	TCEQ SOP, V1	89857	NA	NA	NA	NA	NA	GBRA
Maximum daily DO	mg/L	water	TCEQ SOP, V1	89856	NA	NA	NA	NA	NA	GBRA
Minimum daily DO	mg/L	water	TCEQ SOP, V1	89855	NA	NA	NA	NA	NA	GBRA
Number of DO measurements	none	none	TCEQ SOP, V1	89858	NA	NA	NA	NA	NA	GBRA
Number of temperature measurements	none	none	TCEQ SOP, V1	00221	NA	NA	NA	NA	NA	GBRA
Number of conductivity measurements	none	none	TCEQ SOP, V1	00222	NA	NA	NA	NA	NA	GBRA
Number of pH measurements	none	none	TCEQ SOP, V1	00223	NA	NA	NA	NA	NA	GBRA
24-hour average water temperature	^{o}C	water	TCEQ SOP, V1	00209	NA	NA	NA	NA	NA	GBRA
Maximum daily water temperature	^{o}C	water	TCEQ SOP, V1	00210	NA	NA	NA	NA	NA	GBRA
Minimum daily water temperature	^{o}C	water	TCEQ SOP, V1	00211	NA	NA	NA	NA	NA	GBRA
24-hour average conductivity	umhos/cm	water	TCEQ SOP, V1	00212	NA	NA	NA	NA	NA	GBRA

PARAMETER	UNITS	MATRIX	METHOD	PARA-METER CODE	AWRL	LOQ	LOQ CHECK STD %Rec	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
Maximum daily conductivity	umhos/cm	water	TCEQ SOP, V1	00213	NA	NA	NA	NA	NA	GBRA
Minimum daily conductivity	umhos/cm	water	TCEQ SOP, V1	00214	NA	NA	NA	NA	NA	GBRA
Maximum daily pH	s.u.	water	TCEQ SOP, V1	00215	NA	NA	NA	NA	NA	GBRA
Minimum daily pH	s.u.	water	TCEQ SOP, V1	00216	NA	NA	NA	NA	NA	GBRA
Gain/Loss Survey										
Flow	cfs	water	USGS	00061	NA[1]	NA	NA	NA	NA	USGS
Flow measurement method	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	USGS	89835	NA[1]	NA	NA	NA	NA	USGS

1 Reporting to be consistent with TCEQ SWQM guidance and based on measurement capability.
2 Based on range statistic as described in Standard Methods, 20th Edition, Section 9020-B, "Quality Assurance / Quality Control – Intralaboratory Quality Control Guidelines." This criterion applies to bacteriological duplicates with concentrations greater than 10 MPN/100 mL or greater than 10 organisms/100 mL.
3 Secondary method listed. To be used in the event that the primary method cannot be used or needs to be confirmed, i.e. automated method cannot be used due to instrument failure.
4 In addition to SM 10200 H. cited for chlorophyll a, the SOP posted on the TCEQ CRP web site will be followed as well.
5 Automated method for total phosphorus on the Konelab Aquakem 200, following the GBRA SOP written based on the EPA method 365.3 and the Konelab operating procedures. The manual method will be used as a secondary method in case of instrument failure.
6 The SARA-EL may be used in the event of lab equipment failure so that samples will be processed within prescribed holding times. In the case of *E. coli*, SARA-EL will analyze the samples using method SM9223B for which they are accredited. SARA LOQ may be different from GBRA LOQ.
7 Reporting limit. Not a NELAP-defined LOQ (no commercially available spiking solution used as LOQ check standard.)
8 E.coli samples analyzed by SM 9223-B should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours (i.e. stormwater event), the holding time may be extended and samples must be processed as soon as possible and within 24 hours.

References for Table A7.1:

United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, 1998

TCEQ SOP, V1 - TCEQ SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, June 2008 or subsequent editions (RG-415)

Ambient Water Reporting Limits (AWRLs)

The AWRL establishes the reporting specification at or below which data for a parameter must be reported to be compared with freshwater screening criteria. The AWRLs specified in Table A7.1 are the program-defined reporting specifications for each analyte and yield data acceptable for TCEQ water quality assessment. The LOQ (formerly known as reporting limit) is the minimum level, concentration, or quantity of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The following requirements must be met in order to report results to the TSSWCB:

- The laboratory's LOQ for each analyte must be at or below the AWRL as a matter of routine practice
- The laboratory must demonstrate its ability to quantitate at its LOQ for each analyte by running an LOQ check standard for each batch of samples analyzed.

Laboratory Measurement QC Requirements and Acceptability Criteria are provided in Section B5.

Precision

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. It is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions, and is an indication of random error. Subsequent flow measurements, collected through the gain/loss survey, will be collected during each synopsis if the measurements exceed the measurement criteria of greater than 3% deviation from the preceding measurement.

Field splits are used to assess the variability of sample handling, preservation, and storage, as well as the analytical process, and are prepared by splitting samples in the field. Control limits for field splits are defined in Section B5.

Laboratory precision is assessed by comparing replicate analyses of laboratory control samples in the sample matrix (e.g. deionized water, sand, commercially available tissue) or sample/duplicate pairs in the case of bacterial analysis. Precision results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for precision are defined in Table A7.1.

Bias

Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is determined through the analysis of laboratory control samples and LOQ check standards prepared with verified and known amounts of all target analytes in the sample matrix (e.g. deionized water) and by calculating percent recovery. Results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for LCSs are specified in Table A7.1.

Representativeness

Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TCEQ SWQM SOPs, and use of only approved analytical methods will assure that the measurement data represents the conditions at the monitoring sites. Routine data collected for this project and submitted to TSSWCB for water quality assessments, are considered to be spatially and temporally representative of routine water quality conditions. Water quality data are collected on a routine frequency and are separated by approximately even time intervals. At a minimum, samples are collected over four seasons (to include inter-seasonal variation) and in the case of diurnal sampling, monthly during an index period (March 15 - October 15). Although data may be collected during varying regimes of weather and flow, the data sets collected during routine monitoring will not be biased toward unusual conditions of flow, runoff, or season. The goal for meeting total representation of the waterbody will be tempered by the availability of stream and meteorological conditions during the project and the potential funding for complete representativeness.

Data collection for targeted sampling will be toward both ambient conditions and those conditions that are influenced by storm events. Spring flow will be collected spatially, seasonally and under varying meteorological conditions. Sampling of wastewater treatment facilities will be conducted once per quarter and at the same time of day and week, without regard to specific meteorological conditions or facility flow regimes. Automated stormflow sampling will be conducted at three locations in the watershed a minimum of once per season as meteorological conditions allow. Representativeness will be measured with the completion of sample collection in accordance with the approved QAPP.

Gain/Loss Survey: Site selection, the appropriate sampling regime, the measurement of flow according to the USGS's SOPs (Appendix F), will assure that the measurement data represents the conditions at the monitoring sites. The goal for meeting total representation of the water body will be tempered by the availability of stream and meteorological conditions during the project and the potential funding for complete representativeness.

Comparability

Confidence in the comparability of routine data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and in TCEQ SWQM SOPs. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10.

Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project that 90% data completion is achieved.

A8 SPECIAL TRAINING/CERTIFICATION

New field personnel receive training in proper sampling and field analysis. Before actual sampling or field analysis occurs, they demonstrate to the GBRA QAO (or designee) their ability to properly calibrate field equipment and perform field sampling and analysis procedures. Field personnel training is documented and retained in the personnel file and are available during a monitoring systems audit.

Contractors and subcontractors must ensure that laboratories analyzing samples under this QAPP meet the requirements contained in section 5.4.4 of the NELAC® standards (concerning Review of Requests, Tenders and Contracts).

Gain/Loss Survey: New field personnel receive training in proper methods described in Appendix B. Before actual sampling or field analysis occurs, they demonstrate to the QA Officer (or designee) their ability to properly calibrate field equipment and perform field sampling and analysis procedures. Field personnel training is documented and retained in the personnel file and are available during a monitoring systems audit.

A9 DOCUMENTS AND RECORDS

The documents and records that describe, specify, report, or certify activities are listed. These reports may or may not be kept in paper form since the reports can be regenerated from the lab database at any time. If kept, the paper form is kept for a minimum of one year and then scanned into the GBRA ITRAX for permanent record.

The GBRA laboratory database is housed on the laboratory computer and is backed up on the network server nightly. A back up copy of the network server files, including ITRAX, is made every Monday and that copy is stored off-site at a protected location. The GBRA network administrator is responsible for the servers and back up generation.

Gain/Loss Survey: The documents and records that describe, specify, report, or certify activities are listed. These reports may or may not be kept in paper form since the reports can be regenerated from the USGS NWIS database at any time. If kept, the paper form is kept for a minimum of one year and then scanned for permanent record (Appendix G).

Table A9.1 Project Documents and Records

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	TSSWCB/GBRA/USGS	One Year/ Indefinitely	Paper/ Electronic
QAPP distribution documentation	GBRA/USGS	One Year/ Indefinitely	Paper/ Electronic
QAPP commitment letters	GBRA/USGS	One Year/ Indefinitely	Paper/ Electronic
Field notebooks or data sheets	GBRA/USGS	One Year/ Indefinitely	Paper/ Electronic
Field staff training records	GBRA/USGS	One Year/ Indefinitely	Paper/ Electronic
Field equipment calibration/maintenance logs	GBRA/USGS	One Year/ Indefinitely	Paper/ Electronic
COC records	GBRA/SARA/USGS	One Year/ Indefinitely	Paper/ Electronic
Field SOPs	GBRA/USGS	One Year/ Indefinitely	Paper/ Electronic
Laboratory QA Manuals	GBRA/SARA	One Year/ Indefinitely	Paper/ Electronic
Laboratory SOPs	GBRA/SARA	One Year/ Indefinitely	Paper/ Electronic
Laboratory data reports/results	GBRA/SARA	One Year/ Indefinitely	Paper/electronic
Laboratory staff training records	GBRA/SARA	One Year/ Indefinitely	Paper/ Electronic
Instrument printouts	GBRA/SARA	One Year/ Indefinitely	Paper/ Electronic
Laboratory equipment maintenance logs	GBRA/SARA	One Year/ Indefinitely	Paper/ Electronic
Laboratory calibration records	GBRA/SARA	One Year/ Indefinitely	Paper/ Electronic
Corrective Action Documentation	GBRA/SARA	One Year/ Indefinitely	Paper/ Electronic

The TSSWCB may elect to take possession of records at the conclusion of the specified retention period.

Laboratory Test Reports

Test reports from the laboratory will document the test results clearly and accurately. The requirements for reporting data and the procedures are provided.

* title of report and unique identifiers on each page
* name and address of the laboratory
* name and address of the client
* a clear identification of the sample(s) analyzed
* date and time of sample receipt
* date and time of collection
* sample depth
* identification of method used
* identification of samples that did not meet QA requirements and why (i.e., holding times exceeded)
* sample results
* units of measurement
* sample matrix
* dry weight or wet weight (as applicable)
* clearly identified subcontract laboratory results (as applicable)
* a name and title of person accepting responsibility for the report
* project-specific QC results to include field split results (as applicable); equipment, trip, and field blank results (as applicable); and LOQ and LOD confirmation (% recovery)
* narrative information on QC failures or deviations from requirements that may affect the quality of results or is necessary for verification and validation of data
* certification of NELAC® compliance on a result by result basis.

Electronic Data

Data will be submitted electronically to the TCEQ SWQMIS. A completed Data Summary (see Appendix D), as described in the most recent version of *TCEQ SWQM Data Management Reference Guide*, will be submitted with each data submittal.

Amendments to the QAPP

Revisions to the QAPP may be necessary to address incorrectly documented information or to reflect changes in project organization, tasks, schedules, objectives, and methods. Requests for amendments will be directed from the GBRA Project Manager to the TSSWCB Project Manager electronically. Amendments are effective immediately upon approval by the GBRA Project Manager, the GBRA QAO, the TSSWCB Project Manager, and the TSSWCB QAO. They will be incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list by the GBRA Project Manager.

B1 SAMPLING PROCESS DESIGN

The sample design is based on the intent of this project as recommended by the PCWP Steering Committee. Under their direction, the TSSWCB and GBRA have been tasked with providing data to characterize water quality conditions in support of the 305(b) assessment, and to identify significant long-term water quality trends. Based on PCWP Steering Committee input, achievable water quality objectives and priorities and the identification of water quality issues were used to develop the workplan, which are in accord with available resources. As part of the PCWP Steering Committee process, the TSSWCB and GBRA coordinate closely with other participants to ensure a comprehensive water monitoring strategy within the watershed.

Routine monitoring will complement existing routine ambient monitoring being conducted by GBRA. The five new routine monitoring sites have been selected to increase the spatial distribution of data. Monthly routine monitoring includes the conventional, bacterial and field parameter groups (*E. coli*, pH, DO, temperature, specific conductance, chloride, sulfate, chlorophyll a, pheophytin, nitrate-nitrogen, ammonia-nitrogen, total hardness, TSS, turbidity, total phosphorus and total kjeldahl nitrogen) that are currently collected at the three existing sites being monitored by GBRA. Analytical results will be used in assessments conducted by TCEQ and compared to historical data at the existing monitoring locations in the watershed. Flow will be measured by the USGS gaging station for sites 12642 and 12640. Flow at the remaining routine sites will be measured manually (mechanically, electronically or by Doppler.)

In addition to routine monitoring at these locations, 24-hour diurnal monitoring will be conducted once per month during the index period, March 15 through October 15, except at station 12647, Plum Creek at CR202, where GBRA maintains a continuous water quality monitoring station. DO, pH, temperature, and specific conductance will be recorded hourly through the diurnal cycle. Flow at station 12640 will be measured using the nearest USGS gage station. At the remaining six stations, stream flow will be measured manually at the time of data sonde deployment. Minimum, maximum, range, average (not pH) and number of measurements will be reported for each parameter.

Sites for targeted monitoring were selected to represent spatial, seasonal and meteorological conditions throughout the Plum Creek and contributing subwatersheds. Sampling will be conducted two times per season for 11 seasons, once under dry weather conditions and once during wet weather conditions. The area has been known to experience scattered showers, i.e., afternoon heat-related showers of short duration that may cause some portions of the watershed to be under wet weather conditions while others are not. Targeted monitoring sites will be visited when the overall watershed is under the specific weather conditions, dry or wet. There may be times, during dry weather conditions, when there is no water in the stream in the subwatersheds. Those visits will be documented but no stream data will be collected. During wet weather conditions, the safety of the sampling crew will not be compromised in case of lightning or flooding. In the instance that a sampling site is inaccessible due to weather conditions or flooding, "no sample due to inaccessibility" will be documented in the field notebook. The routine monitoring sites will be targeted for wet weather conditions during each quarter if none of the routine monitoring events conducted met those conditions during that season, or targeted for dry conditions if those conditions were not met during that season.

Seven WWTFs will be sampled once per month over the span of the project (34 months). Data will be collected to characterize the wastewater facilities' contributions to the flow regime and pollutant loading. Samples will be collected at the outfall of each facility, before it mixes with the receiving stream. Parameters will include flow, field, and conventional parameters, including BOD, CBOD and COD. The WWTFs measure the effluent flow in million gallons per day. At the time of sampling, the flow will be obtained from the WWTF and converted to cubic feet per second.

Three spring flow sites have been identified using local and historical knowledge. GBRA will conduct spring flow monitoring at the 3 springs once per season collecting field, conventional, flow and bacteria parameter groups. Sampling period extends through 11 seasons. The data will be collected at a location that is in the closest proximity to the headwaters of each spring and with enough depth to collect a representative sample. Care will be given to sample above stream features such as riffles that could influence water quality after the spring emerges from the ground. Flow will be measured manually at each spring.

GBRA will conduct automated storm flow monitoring at 3 urban/residential sites during 4 storm events annually to characterize urban/residential NPS loadings. Sampling period extends over 12 months. Depending on meteorological conditions, seasonal variation in storm events will be captured. Storm flow samples will be retrieved within 24 hours. Up to 24 discreet samples will be collected for bacteriological analyses, and the remaining volume will be composited in order to produce event mean concentrations for other parameters. A storm event will be defined as a one inch rise in the stream channel, measured by a bubble gage on the autosampler. The autosampler will be calibrated to reflect flow conditions at the monitoring location and be equipped with a rain gage. Holding times for conventional parameters will begin at the time that the last sample for the composite is collected. Bacteriological analyses will be conducted on the proportional samples collected every hour by the automated sampler. The holding time for the *E. coli* samples collected by the autosampler during a storm event will be extended for up to 24 hours. This holding time applies when transport conditions necessitate delays longer than 6 hours. During a storm event, the safety of the sampling crew will not be compromised in case of lightning or flooding. In the instance that the storm flow sampler is inaccessible due to weather conditions or flooding, the sampler will be retrieved when conditions allow and the event will be documented in the field notebook. Samples from these severe weather events will not be analyzed if inaccessibility prevents compliance with holding times.

To better understand the sources of flow in the Plum Creek watershed, two sets of synoptic gain/loss measurements will be collected by USGS at five selected surface water locations within the watershed. Surface-water discharge measurements collected at each gain/loss location will include at a minimum, two independent flow measurements, for a total of 20 discharge measurements for both synoptic events. Subsequent additional flow measurements may be collected during each synopsis, if the measurements exceed the measurement criteria of greater than 3% deviation from the preceding measurement.

See Appendix A for sampling process design information and monitoring tables associated with data collected under this QAPP.

B2 SAMPLING METHODS

Field Sampling Procedures

Field sampling will be conducted according to procedures documented in the *TCEQ Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008.(RG-415)* and *Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data (RG-416),* or the most recent version and any interim changes posted to the Surface Water Quality Monitoring Procedures website (http://www.tceq.texas.gov/waterquality/monitoring/swqm_procedures.html). Updates shall be incorporated into program procedures, QAPP, SOPs, etc., within 60 days of any final published version. All following references to "TCEQ Surface Water Quality Monitoring Procedures," "TCEQ Surface Water Quality Monitoring Procedures as amended," "SWQM Procedures," "SWQM Procedures Manual," "*TCEQ Surface Water Quality Monitoring Procedures Volume 1 (RG-415)," and "TCEQ Surface Water Quality Monitoring Procedures Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data (RG-416)," refer to this section and are used interchangeably.* Additional aspects outlined in Section B below reflect specific requirements for sampling under this project and/or provide additional clarification.

Storm event runoff water samples will be collected using refrigerated ISCO Avalanche samplers. Initial water level, date, time, and collector's name will be recorded at the time of sampling. Water samples will be collected based on time. Samplers will be triggered when water level has >1 inch rise over ambient flow, measured by a bubble gage. The storm water stations are not located at gaged, calibrated sites. It is recognized that an estimate of volume is rough at best after overbanking occurs. The samplers will be visited periodically to set ambient water levels. Once the water level rise triggers the sampler, data will be recorded at one hour intervals. An estimate of volume will be done based on the measurement of the pressure gage on the ISCO at the time of each hourly sample and used to calculate the flow-weighted composite and the estimated pollutant load. Nine hundred milliliters of water will be collected into 950-mL bottles every hour for 24 hours. After the first sample is collected until the completion of the 24 hours, the Avalanche cools the refrigerated compartment to 1^oC +/- 1. One hour after the last sample is collected, the Avalanche adjusts its control to maintain the samples at 3^oC +/- 1. The Avalanche sampler is equipped with 14 sterile bottles. Before 14 hours has passed, the full bottles will be replaced with new sterile bottles in order to complete a 24-hour sampling cycle. The full sample bottles will be labeled with date, time and collector's name. The samples will be transported in an iced container and delivered to the laboratory where each sample will be analyzed for E. coli. The remaining volume in each bottle will be refrigerated.

After the full 24-hour cycle has been collected, a flow-weighted 4-L composite sample will be prepared using the remaining volume from the 24 samples. Samples will be analyzed for TKN, TP, NH3-N and NO3-N. Aliquots for NO_3-N analysis will be filtered using a 0.45 micron filter. The remaining volume will be preserved with H_2SO_4 to a pH of less than 2. Storm water sample data will be used to quantify E. coli concentrations over the storm water hydrograph as well as to quantify the nutrient loading contributed during each storm event. The estimation of bacteriological load will be calculated based on the volume of water that has passed between each sample and the concentration of E. coli measured at the previous hourly sample. The estimate of the total bacterial load will be the sum of each hourly load over the storm hydrograph. Only the samples collected when flow is over the trigger level will be used in the load calculation and nutrient composite sample. Storm water sampling cannot be regularly scheduled as it is dependent on climatic conditions of the study area. Therefore, due to the climate of the project area storm sampling will continue through the duration of the project due to the limited amounts of rainfall.

Gain/Loss Survey: Field sampling will be conducted according to procedures documented in the *USGS Techniques and Methods 3-A8, Discharge Measurements at Gaging Stations, Chapter 8 of Book 3, Section A* (Appendix F) and *Quality Management Plan for Environmental Projects* (Appendix G*)*.

Table B2.1 Sample Storage, Preservation and Handling Requirements

Parameter	Matrix	Container	Preservation*	Sample Volume	Holding Time
Turbidity	Water	Plastic or glass	Cool, 0-6°C	100 mL	48 hours
Hardness	Water	Plastic or glass	Cool, 0-6°C, H_2SO_4 to pH < 2*	1 L	28 days
TSS	Water	Plastic or glass	Cool, 0-6°C	1 L	7 days
Nitrate-nitrogen	Water	Plastic or glass	Cool, 0-6°C	1 L	48 hours
Ammonia-nitrogen	Water	Plastic or glass	Cool, 0-6°C, H_2SO_4 to pH < 2*	1 L	28 days
Total Kjeldahl Nitrogen	Water	Plastic or glass	Cool, 0-6°C, H2SO4 to pH < 2*	1 L	28 days
Total Phosphorus	Water	Plastic or glass	Cool, 0-6°C, H_2SO_4 to pH < 2*	1 L	28 days
Sulfate	Water	Plastic or glass	Cool, 0-6°C	1 L	28 days
Chloride	Water	Plastic or glass	Cool, 0-6°C	1 L	28 days
Chlorophyll a /Pheophytin	Water	Amber plastic or glass	Dark, Cool, 0-6°C before filtration; Dark, 0°C after filtration	1 L	Filter within 48 hours/28 days at 0°C
*E. coli***	Water	Sterile, plastic	Cool, 0-6°C	100 mL	6 hours
BOD	Water	Plastic	Cool, 0-6°C	1 L	48 hours
C-BOD	Water	Plastic	Cool, 0-6°C	1 L	48 hours
COD	Water	Plastic	Cool, 0-6°C, H_2SO_4 to pH < 2*	1 L	28 days

* Preservation occurs within 15 minutes of sample collection or within 15 minutes of the creation of the composite of rainfall sampling
** *E.coli* samples analyzed by SM 9223-B should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 24 hours.

Storm Event Holding Time

Stormwater samples will be collected using automatic ISCO samplers as described above. The samples will be transported in an iced container and delivered to the GBRA laboratory for analysis. A minimum of 950 mL will be collected by automatic samplers into sterile plastic bottles and, when removed from the automatic samplers, stored on ice at 4°C. Hourly samples must be removed from refrigerated automated samplers, transported to the laboratory and analyzed for E. coli within 24 hours of the first sample collected. After the complete 24-hour cycle has been collected, the flow-weighted composite sample will be made, a portion filtered for nitrate-nitrogen analysis, and the remaining sample acidified with H_2SO_4 to a pH of less than 2. The composite sample will be placed in the refrigerator at 0-6°C. Analysis of the composite sample for nutrients will adhere to the holding times prescribed in Table B2.1. The holding time will begin at the time that the last sample for the composite is collected. Samples from these severe weather events will not be analyzed if inaccessibility prevents compliance with holding times.

Sample Containers

Sample containers are plastic one liter bottles that are cleaned and reused for conventional parameters. The bottles are cleaned with the following procedure: 1) wash containers with tap water and alconox (laboratory detergent), 2) triple rinse with hot tap water, and 3) triple rinse with deionized water. Amber plastic bottles are used routinely for chlorophyll samples. Disposable, pre-cleaned, sterile bottles are purchased for bacteriological samples. For storm water samples used in the ISCO Avalanche autosampler, the bottles are cleaned with the following procedure: 1) wash containers with tap water and alconox (laboratory detergent), 2) triple rinse with hot tap water, and 3) triple rinse with deionized water, followed by sterilization by autoclave. Certificates of analysis and/or sterility sample containers for bacteriological sampling are maintained in a notebook by each laboratory.

Processes to Prevent Contamination

Procedures outlined in the TCEQ *SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008* (RG-415) outline the necessary steps to prevent contamination of samples, including direct collection into sample containers, when possible. Field QC samples (identified in Section B5) are collected to verify that contamination has not occurred.

Documentation of Field Sampling Activities

Field sampling activities are documented on field data sheets as presented in Appendix B. The following will be recorded for all visits:

- Station ID
- Sampling date
- Location
- Sampling depth
- Sampling time
- Sample collector's name/signature
- Values for all field parameters, including flow and flow severity
- Detailed observational data, including:
- water appearance
- weather
- biological activity
- unusual odors
- pertinent observations related to water quality or stream uses (i.e., exceptionally poor water quality conditions/standards not met; stream uses such as swimming, boating, fishing, irrigation pumps)
- watershed or instream activities (i.e., bridge construction, livestock watering upstream)

- missing parameters (i.e., when a scheduled parameter or group of parameters is not collected)

Recording Data

For the purposes of this section and subsequent sections, all field and laboratory personnel follow the basic rules for recording information as documented below:

- Legible writing in indelible ink with no modifications, write-overs or cross-outs;
- Correction of errors with a single line followed by an initial and date;
- Close-out on incomplete pages with an initialed and dated diagonal line.

Deficiencies, Nonconformances and Corrective Action Related to Sampling Requirements

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to sampling methods requirements include, but are not limited to, such things as sample container, volume, and preservation variations, improper/inadequate storage temperature, holding-time exceedances, and sample site adjustments.

Deficiencies are documented in logbooks, field data sheets, etc., by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the GBRA Project Manager. The GBRA Project Manager will notify the GBRA QAO of the potential nonconformance. The GBRA QAO will initiate a NCR to document the deficiency.

The GBRA Project Manager, in consultation with the GBRA QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the GBRA Project Manager, in consultation with GBRA QAO, will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the GBRA QAO by completion of a CAR.

CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

Deficiencies, Nonconformances and Corrective Action Related to Gain/Loss Measurement Requirements

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to sampling methods requirements include, but are not limited to, such things as sample container, volume, and preservation variations, improper/inadequate storage temperature, holding-time exceedances, and sample site adjustments.

Deficiencies are documented in logbooks, field data sheets, etc. by field staff and reported to the cognizant field supervisor who will notify the USGS Project Manager. The USGS Project Manager will notify the GBRA Project Manager of the potential nonconformance. The GBRA Project Manager will initiate a Nonconformance Report (NCR) to document the deficiency.

The USGS Project Manager, in consultation with the GBRA Project Manager (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the USGS Project Manager, in consultation with GBRA Project Manager, will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the USGS Project Manager by completion of a Corrective Action Report.

Corrective Action Reports (CARs) document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B3 SAMPLE HANDLING AND CUSTODY

Sample Tracking

Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, and analysis.

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is a record that documents the possession of the samples from the time of collection to receipt in the laboratory. The following information concerning the sample is recorded on the COC form (See Appendix C). The following list of items matches the COC form in Appendix C.

- Date and time of collection
- Site identification
- Sample matrix
- Number of containers and respective volumes
- Preservative used or if the sample was filtered
- Analyses required
- Name of collector
- Custody transfer signatures and dates and time of transfer
- Bill of lading (if applicable)
- Subcontract laboratory, if used

Sample Labeling

Samples from the field are labeled on the container with an indelible marker. Label information includes:

- Site identification
- Date and time of sampling
- Preservative added, if applicable
- Designation of "field-filtered" as applicable
- Sample type (i.e., analysis(es)) to be performed

Sample Handling

After collection of samples are complete, sample containers are immediately stored in an ice chest for transport to the GBRA laboratory, accompanied by the COC form. Ice chests will remain in the possession of the field technician or in the locked vehicle until delivered to the lab. After receipt at the GBRA lab, the samples are stored in the refrigeration unit or given to the analyst for immediate analysis. Only authorized laboratory personnel will handle samples received by the laboratory.

Deficiencies, Nonconformances and Corrective Action Related to Chain of Custody

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to COC include but are not limited to delays in transfer, resulting in holding time violations; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the GBRA Project Manager. The GBRA Project Manager will notify the GBRA QAO of the potential nonconformance. The GBRA QAO will initiate a NCR to document the deficiency.

The GBRA Project Manager, in consultation with GBRA QAO, will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the GBRA Project Manager in consultation with the GBRA QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the GBRA QAO by completion of a CAR.

CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B4 ANALYTICAL METHODS

The analytical methods, associated matrices, and performing laboratories are listed in Table A7.1. The authority for analysis methodologies under this project is derived from the TSWQS (Texas Administrative Code §§307.1 - 307.10) in that data generally are generated for comparison to those standards and/or criteria. The standards state that “Procedures for laboratory analysis must be in accordance with the most recently published edition of the book entitled Standard Methods for the Examination of Water and Wastewater, the TCEQ Texas Surface Water Quality Monitoring Procedures as amended, 40 CFR Part 136, or other reliable procedures acceptable to the commission, and in accordance with Chapter 25 of this title.”

Laboratories collecting data under this QAPP are compliant with the NELAC® standards, at a minimum. Copies of laboratory QASMs and SOPs are available for review by the TSSWCB.

Standards Traceability

All standards used in the field and laboratory are traceable to certified reference materials. Standards preparation is fully documented and maintained in a standards log book. Each documentation includes information concerning the standard identification, starting materials, including concentration, amount used and lot number; date prepared, expiration date and preparer’s initials/signature. The reagent bottle is labeled in a way that will trace the reagent back to preparation. Table A7.1 lists the methods to be used for field and laboratory analyses.

Deficiencies, Nonconformances and Corrective Action Related to Analytical Methods

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to field and laboratory measurement systems include, but are not limited to, instrument malfunctions, blank contamination, QC sample failures, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the GBRA Project Manager. The GBRA Project Manager will notify the GBRA QAO of the potential nonconformance. The GBRA QAO will initiate a NCR to document the deficiency.

The GBRA Project Manager, in consultation with GBRA QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the GBRA Project Manager, in consultation with the GBRA QAO, will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the GBRA QAO by completion of a CAR (see Appendix E).

CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B5 QUALITY CONTROL

Sampling Quality Control Requirements and Acceptability Criteria

The minimum Field QC Requirements are outlined in the TCEQ *SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008* (RG-415). Specific requirements are outlined below. Field QC sample results are submitted with the laboratory data report (see Section A9).

Field Split **-** A field split is a single sample subdivided by field staff immediately following collection and submitted to the laboratory as two separately identified samples according to procedures specified in the TCEQ *SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008* (RG-415). Split samples are preserved, handled, shipped, and analyzed identically and are used to assess variability in all of these processes. Field splits apply to conventional samples only and are collected on a 10% basis, or one per batch, whichever is more frequent.

The precision of field split results is calculated by RPD using the following equation:

$$RPD = (X_1\text{-}X_2)/((X_1+X_2)/2)) * 100\%$$

A 30% RPD criteria will be used to screen field split results as a possible indicator of excessive variability in the sample handling and analytical system. If it is determined that elevated quantities of an analyte (i.e., > RL) were measured and analytical variability can be eliminated as a factor, then variability in field split results will primarily be used as a trigger for discussion with field staff to ensure samples are being handled in the field correctly. Some individual sample results may be invalidated based on the examination of all extenuating information. The information derived from field splits is generally considered to be event specific and would not normally be used to determine the validity of an entire batch; however, some batches of samples may be invalidated depending on the situation. Professional judgment during data validation will be relied upon to interpret the results and take appropriate action. The qualification (i.e., invalidation) of data will be documented on the Data Summary. Deficiencies will be addressed as specified in this section under Deficiencies, Nonconformances, and Correction Action related to QC.

Sampling Quality Control Requirements and Acceptability Criteria-Gain/Loss Survey

The minimum Field QC Requirements for the synoptic surveys are outlined in the *USGS Techniques and Methods 3-A8, Discharge Measurements at Gaging Stations, Chapter 8 of Book 3, Section A* (Appendix F) and *Quality Management Plan for Environmental Projects* (Appendix G*)*.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Method Specific QC requirements – QC samples, other than those specified later this section, are run (i.e., sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples, positive control, negative control, and media blank) as specified in the methods. The requirements for these samples, their acceptance criteria or instructions for establishing criteria, and corrective actions are method-specific.

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory QASMs. The minimum requirements that all participants abide by are stated below.

Limit of Quantitation (LOQ) – The laboratory will analyze a calibration standard (if applicable) at the LOQ on each day the project samples are analyzed. Calibrations including the standard at the LOQ will meet the calibration requirements of the analytical method or corrective action will be implemented.

LOQ Check Standard – An LOQ check standard consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system at the lower limits of analysis. The LOQ check standard is spiked into the sample matrix at a level less than or near the LOQ for each analyte for each batch of samples that are run.

The LOQ check standard is carried through the complete preparation and analytical process. LOQ check standards are run at a rate of one per analytical batch. A batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

The percent recovery of the LOQ check standard is calculated using the following equation in which %R is percent recovery, SR is the sample result, and SA is the reference concentration for the check standard:

$$\%R = SR/SA * 100$$

Measurement performance specifications are used to determine the acceptability of LOQ Check Standard analyses as specified in Table A7.1.

Laboratory Control Standard (LCS) - A LCS consists of a sample matrix (e.g., deionized water) free from the analytes of interest spiked with verified known amounts of analyte. The LCS is spiked into the sample matrix at a level less than or equal to the mid-point of the calibration curve for each analyte. In cases of test methods with very long lists of analytes, LCSs are prepared with all the target analytes and not just a representative number.

The LCS is carried through the complete preparation and analytical process. The LCS is used to document the bias of the analytical process. LCSs are run at a rate of one per batch. A batch is defined as a set of environmental samples that are prepared and/or analyzed together within the same process using the same lot of reagents.

Results of LCSs are calculated by percent recovery (%R), which is defined as 100 times the measured concentration, divided by the true concentration of the spiked sample.

The following formula is used to calculate percent recovery, where %R is percent recovery; SR is the measured result; and SA is the true result:

$$\%R = SR/SA * 100$$

Performance limits and control charts are used to determine the acceptability of LCS analyses. Project control limits are specified in Table A7.1.

Laboratory Duplicates - A laboratory duplicate is prepared in the laboratory by splitting aliquots of an LCS. Both samples are carried through the entire preparation and analytical process. LCS duplicates are used to assess precision and are performed at a rate of one per batch. A batch is defined as a set of environmental samples that are prepared and/or analyzed together within the same process using the same lot of reagents.

For most parameters, precision is calculated by the RPD of LCS duplicate results as defined by 100 times the difference (range) of each duplicate set, divided by the average value (mean) of the set. For duplicate results, X_1 and X_2, the RPD is calculated from the following equation:

$$RPD = (X_1 - X_2)/\{(X_1 + X_2)/2\} * 100$$

A bacteriological duplicate is considered to be a special type of laboratory duplicate and applies when bacteriological samples are run in the field as well as in the lab. Bacteriological duplicate analyses are performed on samples from the sample bottle on a 10% basis. Results of bacteriological duplicates are evaluated by calculating the logarithm of each result and determining the range of each pair.

Performance limits and control charts are used to determine the acceptability of duplicate analyses. Project control limits are specified in Table A7.1. The specifications for bacteriological duplicates in Table A7.1 apply to samples with concentrations > 10 org/100mL.

Matrix spike (MS) –Matrix spikes are prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Spiked samples are routinely prepared and analyzed at a rate of 10% of samples processed, or one per batch whichever is greater. A batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples. The information from these controls is sample/matrix specific and is not used to determine the validity of the entire batch. The MS is spiked at a level less than or equal to the midpoint of the calibration or analysis range for each analyte. Percent recovery (%R) is defined as 100 times the observed concentration, minus the sample concentration, divided by the true concentration of the spike.

The results from matrix spikes are primarily designed to assess the validity of analytical results in a given matrix and are expressed as percent recovery (%R). The laboratory shall document the calculation for %R. The percent recovery of the matrix spike is calculated using the following equation in which %R is percent recovery, SSR is the observed spiked sample concentration, SR is the sample result, and SA is the reference concentration of the spike added:

$$\%R = (SSR - SR)/SA * 100$$

Measurement performance specifications for matrix spikes are not specified in this document.

The results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory shall determine the internal criteria and document the method used to establish the limits. For matrix spike results outside established criteria, corrective action shall be documented or the data reported with appropriate data qualifying codes.

<u>Method blank</u> –A method blank is a sample of matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as the samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the LOQ. For very high-level analyses, the blank value should be less than 5% of the lowest value of the batch, or corrective action will be implemented.

Deficiencies, Nonconformances and Corrective Action Related to Quality Control

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to QC include but are not limited to field and laboratory QC sample failures.

Deficiencies are documented in logbooks, field data sheets, etc., by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the GBRA Project Manager. The GBRA Project Manager will notify the GBRA QAO of the potential nonconformance. The GBRA QAO will initiate a NCR to document the deficiency.

The GBRA Project Manager, in consultation with GBRA QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the GBRA Project Manager in consultation with the

GBRA QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the GBRA QAO by completion of a CAR (see Appendix E).

CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

All sampling equipment testing and maintenance requirements are detailed in the TCEQ *SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008* (RG-415). Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory QASM(s).

Gain/Loss Survey: All sampling equipment testing and maintenance requirements are detailed in the *USGS Techniques and Methods 3-A8, Discharge Measurements at Gaging Stations, Chapter 8 of Book 3, Section A* (Appendix F) and *Quality Management Plan for Environmental Projects* (Appendix G).

B7 INSTRUMENT CALIBRATION AND FREQUENCY

Field equipment calibration requirements are contained in the TCEQ *SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008* (RG-415). Post-calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidate associated data collected subsequent to the pre-calibration and are not submitted to the TCEQ SWQMIS.

Detailed laboratory calibrations are contained within the QASM(s).

Gain/Loss Survey: Field equipment calibration requirements are contained in the *USGS Techniques and Methods 3-A8, Discharge Measurements at Gaging Stations, Chapter 8 of Book 3, Section A* (Appendix F) and *Quality Management Plan for Environmental Projects* (Appendix G).

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

No special requirements for acceptance are specified for field sampling supplies and consumables. All field supplies and consumables are accepted upon inspection for breaches in shipping integrity.

All new batches of field and laboratory supplies and consumables received by the GBRA laboratory are inspected upon receipt for damage, missing parts, expiration date, and storage and handling requirements. Chemicals, reagents, and standards are logged into an inventory database that documents grade, lot number, manufacturer, dates received, opened, and emptied. All reagents shall meet ACS grade or equivalent where required. Acceptance criteria are detailed in organization's SOPs.

Gain/Loss Survey: All new batches of field supplies and consumables received by the USGS are inspected upon receipt for damage, missing parts storage and handling requirements (See *USGS Techniques and Methods 3-A8, Discharge Measurements at Gaging Stations, Chapter 8 of Book 3, Section A* (Appendix F) and *Quality Management Plan for Environmental Projects* (Appendix G*)*.

B9 NON-DIRECT MEASUREMENTS

This QAPP does not include the use of routine data obtained from non-direct measurement sources.

B10 DATA MANAGEMENT

Data Management Process

Field technicians and laboratory personnel follow protocols that ensure that data collected for this project maintains its integrity and usefulness in the WPP implementation process. Field data collected at the time of the sampling event is logged by the field technician, along with notes on sampling conditions on field data sheets. The field sheet is the responsibility of the field technician and is transported with the sample to the laboratory. The lab technician /sample custodian logs the sample in the Lab Samples Database. Each sample is assigned a separate and distinct sample number. The sample is accompanied by a COC form. The lab technician /sample custodian must review the COC to verify that it is filled out correctly and complete. Lab technicians take receipt of the sample and review the COC, begin sample prep or analysis and transfer samples into the refrigerator for storage. The field data sheet and COC form used can be found in Appendices B and C.

Data generated by lab technicians are logged permanently on analysis bench sheets. The data are reviewed by the analyst prior to entering the data into the Lab Samples Database. In the review, the analyst verifies that the data includes date and time of analysis, that calculations are correct, that data includes documentation of dilutions and correction factors, that data meets DQOs and that the data includes documentation of instrument calibrations, standard curves and control standards. A second review by another lab analyst/technician validates that the data meets the DQOs and that the data includes documentation of instrument calibrations, standard curves and control standards. After this review the lab analyst/technician inputs the data and QC information into the Lab Samples Database for report generation and data storage.

The GBRA Regional Laboratory Director supervises the GBRA Regional laboratory and reviews the report that is generated when all analyses are complete. Again, the report is reviewed to see that all necessary information is included and that the DQOs have been met. When the report is complete, the lab director signs the report. If the GBRA lab director or QAO designee feel there has been an error or finds that information is missing, the report is returned to the analyst for review and tracking to correct the error and generate a corrected copy. The GBRA Project Manager reviews the data for reasonableness and if errors or anomalies are found the report is returned to the laboratory staff for review and tracking to correct the error. After review for reasonableness the data is cross-checked to the analysis logs by the GBRA Project Manager. If at any time errors are identified, the laboratory and water quality databases are corrected.

The GBRA Project Manager, in consultation with GBRA QAO (and other affected individuals/organizations), will determine if the error constitutes a nonconformance. If it is determined a nonconformance does exist, the GBRA Project Manager in consultation with the GBRA QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the GBRA QAO by completion of a CAR (see Appendix E).

CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. CARs will be included with data summary report that accompanies the data submittal. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

The GBRA Project Manager is responsible for electronically transmitting the data to the TCEQ SWQMIS. A completed Data Summary, as described in the most recent version of *TCEQ SWQM Data Management Reference Guide*, will be submitted with each data submittal. If errors are found after the TCEQ review, those errors are corrected by the GBRA Project Manager, logged in a data correction log and all participants are notified.

The following flow diagram outlines the path that data that is generated in the field takes:

> Field data collected → Field data sheets → Lab database → Report generation → QC review by GBRA QAO → Data checked for reasonableness by GBRA Project Manager → Data transferred to GBRA water quality database → Data verification to analysis logs by GBRA Project Manager → ASCII file format created → TCEQ SWQMIS

The following flow diagram outlines the path that data that is generated by the lab takes:

> Laboratory data → Laboratory analysis logs → Lab database → Report generation → QC review by GBRA QAO → Data checked for reasonableness by GBRA Project Manager → Data transferred to GBRA water quality database → Data verification to analysis logs by GBRA Project Manager → ASCII file format created → TCEQ SWQMIS

Gain/Loss Survey: The Data Management process utilized by the USGS is described in the Appendix G *USGS Quality Management Plan for Environmental Projects*

Data Errors and Loss

The GBRA Regional Laboratory Director supervises the GBRA Regional laboratory and reviews the report that is generated when all analyses are complete. The report is reviewed to see that all necessary information is included and that the DQOs have been met. When the report is complete, the lab director signs the report. If the GBRA lab director or QAO designee feel there has been an error or finds that information is missing, the report is returned to the analyst for review and tracking to correct the error and generate a corrected copy. The GBRA Project Manager reviews the data for reasonableness and if errors or anomalies are found the report is returned to the laboratory director for review and tracking to correct the error. After review for reasonableness the data is cross-checked to the analysis logs by the GBRA Project Manager. If at any time errors are identified, the laboratory and water quality databases are corrected. The GBRA Project Manager is responsible for electronically transmitting the data to the TCEQ SWQMIS. A completed Data Summary, as described in the most recent version of *TCEQ SWQM Data Management Reference Guide*, will be submitted with each data submittal. If errors are found after the TCEQ review, those errors are corrected by the GBRA Project Manager, logged in a data correction log and all participants are notified.

To minimize the potential for data loss, the databases, both lab and server files are backed up nightly and copies of the files are stored off-site weekly. If the laboratory database or network server fails, the backup files can be accessed to restore operation or replace corrupted files.

Record Keeping and Data Storage

After data is collected and recorded on field data sheets, the data sheets are filed for review and use later. These files are kept in paper form for a minimum of one year and then scanned into the GBRA ITRAX for permanent record.

The data produced during each analysis is recorded on analysis benchsheets. The information contained on the benchsheet includes all QC data associated with each day's or batch's analysis. The data from the benchsheet are transferred to the laboratory database for report generation. The analysis benchsheets are kept in paper form for a minimum of one year and then scanned into the GBRA ITRAX for permanent record.

The data reports that are generated are reviewed by the GBRA laboratory director and signed. They are then given to the GBRA Project Manager for verification. If an anomaly or error is found the report is marked and returned to the laboratory for review, verification and correction, if necessary. These reports may or may not be kept in paper form since the reports can be regenerated from the lab database at any time. If kept, the paper form is kept for a minimum of one year and then scanned into the GBRA ITRAX for permanent record.

The GBRA laboratory database is housed on the laboratory computer and is backed up on the network server nightly. A back up copy of the network server files is made every Monday and that copy is stored off-site at a protected location. The GBRA network administrator is responsible for the servers and back up generation.

After data is electronically submitted to the TCEQ SWQMIS, the file that has been created is kept on the network server permanently. The network server is backed up nightly. Paper copies of the data and field duplicate sample reports are kept for a minimum of one year and then scanned into the GBRA ITRAX for permanent record.

The GBRA ITRAX is part of the network that is backed up each evening. The GBRA records manager is the custodian of these files.

Data Handling, Hardware, and Software Requirements

The laboratory database is housed on a GBRA server and backed up each evening. The laboratory database uses Sequel 2000. The systems are operating in Windows 2010 and any additional software needed for word processing, spreadsheet or presentations uses Microsoft Office 2010.

Information Resource Management Requirements

Data will be managed in accordance with the TCEQ *SWQM Data Management Reference Guide*, GIS Policy (TCEQ OPP 8.11), GPS Policy (TCEQ OPP 8.12) and applicable GBRA information resource management policies. The personnel collecting data for this project do not create TCEQ certified locational data using Global Positioning System (GPS) equipment. GPS equipment may be used as a component of the information required by the Station Location (SLOC) request process, but TCEQ staff are responsible for creating the certified locational data that will ultimately be entered into the TCEQ SWQMIS. Any information developed for this project using a Geographic Information System (GIS) will be used solely to meet deliverable requirements and will not be submitted to the TCEQ as a certified data set.

C1 ASSESSMENTS AND RESPONSE ACTIONS

The following table presents the types of assessments and response actions for data collection activities applicable to the QAPP.

Table C1.1 Assessments and Response Requirements

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	GBRA	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TSSWCB in Quarterly Progress Report
Monitoring Systems Audit of GBRA	Dates to be determined by TSSWCB	TSSWCB	Field sampling, handling and measurement; facility review; and data management as they relate to this project	30 days to respond in writing to the TSSWCB to address corrective actions
Laboratory Inspection	Dates to be determined by TSSWCB	TSSWCB	Analytical and QC procedures employed at the GBRA laboratory and the contracted laboratories	30 days to respond in writing to the TSSWCB to address corrective actions

Corrective Action

The GBRA Project Manager is responsible for implementing and tracking corrective action resulting from audit findings outlined in the audit report. Records of audit findings and corrective actions are maintained by both the TSSWCB and the GBRA Project Managers. Audit reports and corrective action documentation will be submitted to the TSSWCB with the Quarterly Progress Report.

If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work are specified in the agreements in contracts between participating organizations.

C2 REPORTS TO MANAGEMENT

Reports to GBRA Project Management

Laboratory data reports contain QC information so that this information can be reviewed by the GBRA Project Manager. After review, if the GBRA Project Manager finds no anomalies or questionable data, the process of data transmittal to TCEQ SWQMIS begins. Project status, assessments and significant QA issues will be dealt with by the GBRA Project Manager who will determine whether it will be included in reports to the TSSWCB Project Manager.

Reports to TSSWCB

All reports detailed in this section are contract deliverables and are transferred to the TSSWCB in accordance with contract requirements.

Quarterly Progress Report - Summarizes the GBRA's activities for each task; reports monitoring status, problems, delays, and corrective actions; and outlines the status of each task's deliverables.

Monitoring Systems Audit Report and Response - Following any audit performed by the GBRA, a report of findings, recommendations and response is sent to the TSSWCB in the quarterly progress report.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

For the purposes of this document, the term verification refers to the data review processes used to determine data completeness, correctness, and compliance with technical specifications contained in applicable documents (i.e., QAPPs, SOPs, QASMs, analytical methods). Validation refers to a specific review process that extends the evaluation of a data set beyond method and procedural compliance (i.e., data verification) to determine the quality of a data set specific to its intended use.

All field and laboratory will be reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements, and then validated against the project objectives and measurement performance specifications which are listed in Section A7. Only those data which are supported by appropriate QC data and meet the measurement performance specifications defined for this project will be considered acceptable, and will be reported to TCEQ SWQMIS.

D2 VERIFICATION AND VALIDATION METHODS

All field and laboratory data will be reviewed, verified and validated to ensure they conform to project specifications and meet the conditions of end use as described in Section A7 of this document.

Data review, verification, and validation will be performed using self-assessments and peer and management review as appropriate to the project task. The data review tasks to be performed by field and laboratory staff are listed in the first two sections of Table D.2, respectively. Potential errors are identified by examination of documentation and by manual examination of corollary or unreasonable data. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues which can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected. Field and laboratory reviews, verifications, and validations are documented.

After the field and laboratory data are reviewed, another level of review is performed once the data are combined into a data set. This review step, as specified in Table D2.1, is performed by the GBRA Data Manager and QAO. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of laboratory and field data review, evaluation of field QC results, additional evaluation of anomalies and outliers, analysis of sampling and analytical gaps, and confirmation that all parameters and sampling sites are included in the QAPP.

Another element of the data validation process is consideration of any findings identified during the monitoring systems audit conducted by the TSSWCB QAO. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected data will be assessed. After the data are reviewed and documented, the GBRA Project Manager validates that the data meet the DQOs of the project and are suitable for reporting to TCEQ SWQMIS.

If any requirements or specifications of this project are not met, based on any part of the data review, the responsible party should document the nonconforming activities (with a CAR) and submit the information to the GBRA Data Manager with the data. This information is communicated to the TSSWCB by the GBRA in the Data Summary. The data is not transmitted to TCEQ SWQMIS.

Table D2.1 Data Review Tasks

Field Data Review	Responsibility
Field data reviewed for conformance with data collection, sample handling and COC, analytical and QC requirements	GBRA Field Technicians
Post-calibrations checked to ensure compliance with error limits	GBRA Field Technicians
Field data calculated, reduced, and transcribed correctly	GBRA Project Manager
Gain/Loss Survey: Field data reviewed for conformance with data collection, and QC requirements	USGS Field Technicians
Gain/Loss Survey: Post-calibrations checked to ensure compliance with error limits	USGS Field Technicians
Gain/Loss Survey: Field data calculated, reduced, and transcribed correctly	USGS Project Manager
Laboratory Data Review	**Responsibility**
Laboratory data reviewed for conformance with data collection, sample handling and COC, analytical and QC requirements to include documentation, holding times, sample receipt, sample preparation, sample analysis, project and program QC results, and reporting	GBRA/SARA (QAOs)
Laboratory data calculated, reduced, and transcribed correctly	GBRA/SARA (QAOs) and GBRA Project Manager
LOQs consistent with requirements for AWRLs	GBRA/SARA (QAOs) and GBRA Project Manager
Analytical data documentation evaluated for consistency, reasonableness and/or improper practices	GBRA/SARA (QAOs) and GBRA Project Manager
Analytical QC information evaluated to determine impact on individual analyses	GBRA/SARA (QAOs) and GBRA Project Manager
All laboratory samples analyzed for all parameters	GBRA Project Manager
Data Set Review	**Responsibility**
The test report has all required information as described in Section A9 of the QAPP	GBRA Project Manager
Confirmation that field and lab data have been reviewed	GBRA Laboratory Director(QAO) and GBRA Project Manager
Data set (to include field and laboratory data) evaluated for reasonableness and if corollary data agree	GBRA Project Manager
Outliers confirmed and documented	GBRA Project Manager
Field QC acceptable (e.g., field splits and trip, field and equipment blanks)	GBRA Field Technicians
Sampling and analytical data gaps checked and documented	GBRA Field Technicians and GBRA Project Manager
Verification and validation confirmed. Data meets conditions of end use and are reportable	GBRA Project Manager

D3 RECONCILIATION WITH USER REQUIREMENTS

Data produced in this project, and data collected by other organizations (i.e., USGS, TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be used in the implementation and adaptive management of the Plum Creek WPP and will be submitted to the TCEQ SWQMIS for use in the development of the biennial Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d).

Appendix A Sampling Process Design and Monitoring Schedule

Sample Design Rationale

The sample design is based on the intent of this project as recommended by the PCWP Steering Committee. Under their direction, the TSSWCB and GBRA have been tasked with providing data to characterize water quality conditions in support of the 305(b) assessment, and to identify significant long-term water quality trends. Based on PCWP Steering Committee input, achievable water quality objectives and priorities and the identification of water quality issues were used to develop the workplan, which are in accord with available resources. As part of the PCWP Steering Committee process, the TSSWCB and GBRA coordinate closely with other participants to ensure a comprehensive water monitoring strategy within the watershed.

Site Selection Criteria

This data collection effort involves monitoring routine water quality, using procedures that are consistent with the TCEQ SWQM program, for the purpose of data entry into the SWQMIS database maintained by the TCEQ. To this end, some general guidelines are followed when selecting sampling sites, as basically outlined below, and discussed thoroughly in the TCEQ *SWQM Procedures, Volume 1* (RG-415). Overall consideration is given to accessibility and safety. All monitoring activities have been developed in coordination with the PCWP Steering Committee and with the TSSWCB.

1. Locate stream sites so that samples can be safely collected from the centroid of flow. Centroid is defined as the midpoint of that portion of stream width which contains 50 percent of the total flow. If few sites are available for a stream segment, choose one that would best represent the waterbody, and not an unusual condition or contaminant source. Avoid backwater areas or eddies when selecting a stream site.

2. Because historical water quality data can be very useful in assessing use attainment or impairment, those historical sites were selected that are on current or past monitoring schedules.

3. Routine monitoring sites were selected to bracket sources of pollution, influence of tributaries, changes in land uses, and hydrological modifications.

4. Sites should be accessible. When possible, stream sites should have a USGS stream flow gauge. If not, flow measurement will be made during routine and targeted monitoring visits.

Monitoring Sites

The Monitoring Table for this project is presented on the following pages.

Legend:

RT = Program code for routine samples
BF = Program code for targeted monitoring samples (biased flow)
BS = Program code for diurnal monitoring conducted during index period (biased season)
DO 24hr = diurnal monitoring for DO, conductivity, temperature and pH; measurements taken every hour for 24 hours; includes minimum, maximum and average.
Bacteria = *E. coli*
Conventional = TSS, turbidity, sulfate, chloride, nitrate nitrogen, ammonia nitrogen, total kjeldahl nitrogen, chlorophyll a, pheophytin, total hardness, total phosphorus, BOD (effluent only), CBOD (effluent only) and COD (effluent only)
Flow = flow collected by gage, electric, mechanical or Doppler; includes severity
Field = pH, temperature, conductivity, DO

Sampling Site Locations and Monitoring Regime

TCEQ Station ID	Site Description	Workplan Task	Monitor Type	DO 24hr	Bacteria	Conventional	Flow	Field	Comments
12556	Clear Fork Plum Creek at Salt Flat Road	3	RT		34	34	34	34	1
12556	Clear Fork Plum Creek at Salt Flat Road	6	BS	22			22	22	
12556	Clear Fork Plum Creek at Salt Flat Road	4	BF		11	11	11	11	
12556	Clear Fork Plum Creek at Salt Flat Road	10	BF				2		
12558	Elm Creek at CR 233	3	RT		34	34	34	34	1
12558	Elm Creek at CR 233	6	BS	22			22	22	
12558	Elm Creek at CR 233	4	BF		11	11	11	11	
12640	Plum Creek at CR 135	3	RT		34	34	34	34	1, 3
12640	Plum Creek at CR 135	6	BS	22			22	22	
12640	Plum Creek at CR 135	4	BF		11	11	11	11	
12640	Plum Creek at CR 135	10	BF				2		
12647	Plum Creek at Old McMahan Road (CR 202)	3	RT		34	34	34	34	1, 3
12647	Plum Creek at Old McMahan Road (CR 202)	5	BF		4	4	4	4	5
12647	Plum Creek at Old McMahan Road (CR 202)	6	BS	22			22	22	
12647	Plum Creek at Old McMahan Road (CR 202)	4	BF		11	11	11	11	
12647	Plum Creek at Old McMahan Road (CR 202)	10	BF				2		
17406	Plum Creek at Plum Creek Road	3	RT		34	34	34	34	1, 3
17406	Plum Creek at Plum Creek Road	6	BS	22			22	22	
17406	Plum Creek at Plum Creek Road	4	BF		11	11	11	11	
17406	Plum Creek at Plum Creek Road	10	BF				2		
20488	Brushy Creek at Rocky Road (Upstream of NRCS 14)	3	RT		34	34	34	34	1
20488	Brushy Creek at Rocky Road (Upstream of NRCS 14)	6	BS	22			22	22	
20488	Brushy Creek at Rocky Road (Upstream of NRCS 14)	4	BF		11	11	11	11	
20491	Dry Creek at FM 672	3	RT		34	34	34	34	1
20491	Dry Creek at FM 672	6	BS	22			22	22	
20491	Dry Creek at FM 672	4	BF		11	11	11	11	
20500	West Fork Plum Creek at Biggs Road (CR 131)	3	RT		34	34	34	34	1
20500	West Fork Plum Creek at Biggs Road (CR 131)	6	BS	22			22	22	
20500	West Fork Plum Creek at Biggs Road (CR 131)	4	BF		11	11	11	11	
20500	West Fork Plum Creek at Biggs Road (CR 131)	10	BF				2		
12555	Salt Branch at FM 1322	4	BF		22	22	22	22	5
12557	Town Creek at E. Market St. (Upstream of Lockhart #l WWTP)	4	BF		22	22	22	22	
12559	Porter Creek at Dairy Road	4	BF		22	22	22	22	
12642	Plum Creek at Biggs Road (CR 131)	4	BF		22	22	22	22	

TCEQ Station ID	Site Description	Workplan Task	Monitor Type	DO 24hr	Bacteria	Conventional	Flow	Field	Comments
12643	Plum Creek at FM 1322	4	BF		22	22	22	22	
12645	Plum Creek at Young Lane (CR 197)	4	BF		22	22	22	22	
12648	Plum Creek at CR 186	4	BF		22	22	22	22	
12649	Plum Creek at CR 233	4	BF		22	22	22	22	
14945	Clear Fork Plum Creek at Old Luling Road (CR 213)	4	BF		22	22	22	22	
16709	Town Creek West of Lockhart	4	BF		22	22	22	22	
18343	Plum Creek Upstream of US 183	4	BF		22	22	22	22	
20480	Plum Creek Downstream of NRCS 1 Spillway	4	BF		22	22	22	22	
20481	Bunton Branch at Heidenreich Lane	4	BF		22	22	22	22	
20482	Brushy Creek at FM 2001 (Downstream of NRCS 12)	4	BF		22	22	22	22	
20487	Brushy Creek at SH 21	4	BF		22	22	22	22	
20483	Elm Creek at SH 21 (Downstream of NRCS 16)	4	BF		22	22	22	22	
20489	Cowpen Creek at Schuelke Road	4	BF		22	22	22	22	
20496	Tenney Creek at Tenney Creek Road	4	BF		22	22	22	22	
20490	Clear Fork Plum Creek at Farmers Road	4	BF		22	22	22	22	
20493	Clear Fork Plum Creek at PR 10 (State Park)	4	BF		22	22	22	22	
20497	West Fork Plum Creek at FM 671	4	BF		22	22	22	22	
12538	Andrews Branch at CR 131	4	BF		22	22	22	22	
20495	Dry Creek at FM 713	4	BF		22	22	22	22	
20484	Plum Creek at Heidenreich Lane (Downstream of Kyle WWTP)	4	BF		22	22	22	22	5
20501	Salt Branch at Salt Flat Road (Upstream of Luling WWTP)	4	BF		22	22	22	22	
20498	Copperas Creek at Tenney Creek Road/Bronco Lane (CR 141, Downstream of Cal-Maine)	4	BF		22	22	22	22	
20505	Richmond Branch at Dacy Lane	4	BF		22	22	22	22	
20504	Porter Creek Tributary at Quail Cove Road	4	BF		22	22	22	22	
20510	Hines Branch at Tenney Creek Road (CR 141, Downstream of Cal-Maine)	4	BF		22	22	22	22	
20503	Plum Creek at Lehman Road	4	BF		22	22	22	22	
20502	Bunton Branch at Dacy Lane (upstream of NRCS 5)	4	BF		22	22	22	22	
20479	Unnamed Tributary at FM 150 near Hawthorn Dr.	4	BF		22	22	22	22	
20492	10210-001 City of Lockhart and GBRA #1(Larremore plant)	7	-		11	11	11	11	2
20494	10210-002 City of Lockhart and GBRA #2 (FM 20 plant)	7	-		11	11	11	11	2
20499	10582-001 City of Luling	7	-		11	11	11	11	2
20486	11041-002 City of Kyle and Aquasource Inc.	7	-		11	11	11	11	2
99923	11060-001 City of Buda and GBRA	7	-		11	11	11	11	2
99936	14431-001 GBRA Shadow Creek	7	-		11	11	11	11	2
99937	14377-001 GBRA Sunfield	7	-		11	11	11	11	2
20509	Lockhart Springs	8	BS		11	11	11	11	
20507	Clear Fork Springs at Borchert Loop (CR 108)	8	BS		11	11	11	11	
20508	Boggy Creek Springs at Boggy Creek Road (CR 218)	8	BS		11	11	11	11	

1. The eight “routine” sites double as “targeted” sites. “Targeted” sampling will collect biased flow (BF) samples twice per quarter – once under wet weather conditions and once under dry weather conditions. Whether these samples will satisfy the wet (biased high flow) or dry (biased low flow) weather conditions depends on the flow condition when samples are collected during the “routine’ sampling that quarter.
2. The data collected from WWTF sampling will not be used for enforcement or compliance monitoring by TCEQ. As such, results will not be reported to TCEQ for inclusion in any data tracking system. Monitor type code is not applicable.
3. These samples are collected/analyzed by GBRA utilizing Texas CRP funding and serve as a portion of the non-federal match for this project.
4. Sites were adjusted to accommodate access.
5. These site doubles as the “stormflow” monitoring site and one of the “targeted” sampling sites.

Appendix B Field Data Sheet

Texas Commission on Environmental Quality
Surface Water Quality Monitoring Program

Field Data Reporting Form

RTAG# REGION EMAIL-ID: COLLECTOR

STATION ID SEGMENT SEQUENCE DATA SOURCE

Station Description ______________________________

GRAB SAMPLE

M M D D Y Y Y Y — DATE
H H M M — TIME
x — DEPTH
M = meters
F = feet

COMPOSITE SAMPLE

COMPOSITE CATEGORY : T = TIME S = SPACE (i.e. Depth) B = BOTH F = FLOW WEIGHT

M M D D Y Y Y Y — START DATE
H H M M — START TIME
• START DEPTH (SURFACE)
M = Meters F = Feet

M M D D Y Y Y Y — END DATE
H H M M — END TIME
• END DEPTH (DEEPEST)
M = Meters F = Feet

COMPOSITE TYPE : ## = Number of Grabs in Composite CN = Continuous

00010		WATER TEMP (°C only)
00400		pH (s.u)
00300		D.O. (mg/L)
00094		SPECIFIC COND (Φmhos/cm)
00480		SALINITY (ppt, marine only)
89978		PRIMARY CONTACT, OBSERVED ACTIVITY (# of people observed)
89979		EVIDENCE OF PRIMARY CONTACT RECREATION (1 = OBSERVED, 0 = NOT OBSERVED)

72053		DAYS SINCE LAST SIGNIFICANT PRECIPITATION
01351		FLOW SEVERITY 1-no flow 2-low 3-normal 5-high 4-flood 6-dry
00061		INSTANTANEOUS STREAM FLOW (ft^3/sec)
89835		FLOW MEASUREMENT METHOD 1- Flow Gage Station 2- Electric 3- Mechanical 4- Weir/Flume 5-Acoustic Doppler
74069		FLOW ESTIMATE (ft^3/sec)
82903		DEPTH OF BOTTOM OF WATER BODY AT SAMPLE SITE (meters)*
89864		MAXIMUM POOL WIDTH AT TIME OF STUDY (meters)*
89865		MAXIMUM POOL DEPTH AT TIME OF STUDY(meters)
89869		POOL LENGTH (meters) *
89870		% POOL COVERAGE IN 500 M REACH (%) *

*Parameters related to data collection in perennial pools; i.e., Flow Severity of 1 and Flow of 0 cfs reported.

Measurement Comments and Field Observations:

____
____
____

Appendix C Chain of Custody Form

Chain of Custody

Guadalupe-Blanco River Authority Regional Laboratory
933 E. Court Street, Seguin, Texas 78155
830-379-5822 • Fax 830-379-7478

GBRA REGIONAL LABORATORY

NELAP ACCREDITED TNI LABORATORY

Customer Information

Customer Acct. #________________

Name: ________________________ Phone: ________________________

Address: ________________________ Fax: ________________________

________________________ E-mail: ________________________

Sample Collected By: ________________________ ________________________
Signature Printed Name

Residual Chlorine (Total/Free) Results ____________

Thermometer No.____________________ pH Paper GBRA reagent no. ____________

Temp C	Date Collected	Time Collected	Matrix WW=Wastewater DW=Drinking Water SW=Surface Water S=Soils/Sludge O=Other	Sx Vol. P=Plastic G=Glass	Sample Name/Description	TCEQ ID Number	Grab/ Comp.	Analysis Requested	GBRA Sample ID	Bottle ID No.	pH	GBRA# Preservation

Delivered By: __________________ Date/Time ________ Received By: __________________ Date/Time: ________

Delivered By: __________________ Date/Time ________ Received By: __________________ Date/Time: ________

**Special Notes/Ship To: ____________________________________

Ice:______ (Y or N) Number of Containers:______ Condition of Container(s): (intact)________________

RL-042-0101/2010 (QASM App. c) GBRA Doc. 3019-C Rev 14 Eff: 7/30/2010 by JT

Appendix D Data Summary Report

Data Summary

Data Information

Data Source: ______________________________

Date Submitted: ______________________________

Tag_id Range: ______________________________

Date Range: ______________________________

Comments

Please explain in the space below any data discrepancies including:

- **Inconsistencies with AWRL specifications;**
- **Failures in sampling methods and/or laboratory procedures that resulted in data that could not be reported to the TSSWCB; and**
- **Other discrepancies.**

-
-
-
-
-
-
-

Data Manager: ______________________________

Date: ______________________________

Appendix E Corrective Action Form

Corrective Action(s) for: ______________________

Date:____________ **Document # 3016-A**

Analyst:____________ **rev. 3 Eff. 2/16/07 by: JL**

Sample #'s affected____

STATE THE PROBLEM:

CAUSE OF THE PROBLEM(s) (if known):

ACTIONS TAKEN TO RESOLVE PROBLEM (s):

FOLLOW UP:

REVIEWED BY QA OFFICER:(date/sign)

Appendix F USGS Protocol – Discharge Measurements at Gaging Locations

Appendix G USGS Quality Management Plan for Environmental Projects

ATTACHMENT 1

Example Letter to Document Adherence to the QAPP

TO: (name)
(organization)

FROM: (name)
(organization)

Please sign and return this form by (date) to:

(address)

I acknowledge receipt of the referenced document(s). I understand the document(s) describe quality assurance, quality control, data management and reporting, and other technical activities that must be implemented to ensure the results of work performed will satisfy stated performance criteria.

________________________________ _______________
Signature Date

Copies of the signed forms should be sent by the GBRA to the TSSWCB Project Manager within 60 days of EPA approval of the QAPP.